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TESTS ON THE SHATTERING OF GRAPES IN TRANSIT IN SHIPMENTS MADE FROM CALIFORNIA TO NEW YORK, IN AUGUST, SEPTEMBER AND NOVEMBER, 1948.

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Tests on the Shattering of Grapes in Transit in Shipments made from California to New York, in August, September and November, 1948.

Grapes that are sound when packed frequently become loose from their stems while in transit and exude juice resulting in what is termed "wetness" in the grape lug. An analysis of several thousand inspection reports from the New York market has been made by Kaufman. It shows some relationship between the method of loading and severity of the trouble; loads that were squeezed mechanically (Hoak) had less of it than other types of loads that were not customarily squeezed; the trouble was most prevalent in September and October, probably because it was then that heaviest shipments of susceptible varieties reached the market; certain brands had more trouble than others which indicated some relationship between packing and loading supervision and shattering.

The experience of inspectors who have examined thousands of cars of grapes as they are unloaded indicates pretty well that shattering and wetness is most severe in the top layer of the load, and that lugs next to the bulkhead show most of it. Shattering is not usually found in bottom layers or at the doorway. Because of the general interest in the subject, tests were begun in 1948 to get information on the factors causing shattering in transit.

Methods followed

The first series of shipping tests were made the last week in August and the first week in September with the Thompson Seedless variety. Refrigerator cars of identical construction except for differences in draft gears or underframe were assembled for these tests. The same cars had been used for riding quality tests with bananas in July 1/ and were made available through the cooperation of the Pacific Fruit Express Co., Merchants Despatch Transportation Corp., and the Union Pacific and Southern Pacific Railroads.

A second test was made in October with Tokay grapes using no special cars but taking whatever type was available for loading. A third test was made in November with Thompson Seedless grapes out of storage, using non-selected cars as before. Excelsior pads, such as those used in shipping furniture were tried on the bulkheads in some of the cars of the last two tests.

1/ Handling, Transportation and Storage Office Report No. 196

Impact recorders were placed in every test car to show the handling it received in transit. They were installed on the side wall next to the door in the head end of the car and were about 60 inches above the floor. A shelf was built for this purpose in the special cars used in the first test. The impact recorders (Savage) were calibrated prior to their use and had the following characteristics:

> A longitudinal impact of 2 G (G = acceleration due to gravity) was required to move the stylus through one zone on the tape which was divided into 5 zones. All of the zones were 1/2 inch wide with the exception of zone 1 which was 1/4 inch wide. A vertical impact of 0.3 G was required to move the vertical stylus and each 1/10 inch movement was then equal to 0.3 G. There were minor exceptions to this for certain instruments as follows: Recorder 313 required initial acceleration of 0.13 G; recorder 314, 0.48 G; and recorder 306 needed 0.9 G for 0.26 inch record on the tape and .30 G. for each 1/10 inch additional. Empirical ratings have been given longitudinal impacts in terms of railroad handling by the instrument manufacturer. Those in Zone 1 and the first half of Zone 2 are classed as normal handling. The second half of Zone 2 equals border line impacts, those in Zone 3, impacts of speeds of 6 to 7 M.P.H., Zone 4, 8 to 9 M.P.H. and Zone 5, 10 to 11 M.P.H.

Test lugs of grapes to be examined for shattering were placed as part of the load in the top layer at each bulkhead, where damage is usually most severe. The strength of capstem attachment was measured at time of shipment so that susceptibility of the grapes to shattering would be known. A sensitive spring balance was used for this purpose. The inside length of the car and length of load before and after squeezing were measured. The dimensions of the lugs and stripping material were recorded so that a theoretical figure for the length of load could be calculated and compared with its actual length, and thus a figure for slack left in the load could be obtained.

When the cars were unloaded at destination (New York, N. Y. for all cars but one) the percentages of shattered and wet berries in the test lugs were recorded and the commercial load was inspected.

Summary

Many tests will be needed to determine why grapes that are apparently normal in every respect shatter in transit. This is a progress report based upon a limited number of cars. The work represents an initial effort to unravel a problem complicated by many factors that include variety, maturity, loading method, car construction, position in the train and kind

of handling the car received in transit. The results can be summarized as follows:

(1) Cars built with spring cushion underframes (Duryea) showed fewer longitudinal impacts than cars equipped with conventional friction draft gears (Miner) or rubber cushion draft gears (Waughmat). However, these tests indicated, as did a previous one made with bananas, that one of the cars protected the lading from heavy impacts.

(2) A tight load and brace appeared to be the best protection against shattering and wetness. Cars which had all slack removed from the load by using a mechanical squeeze satisfactorily withstood many heavy impacts in transit. This in no way condones the rough handling some of the cars received in transit, but it points to a practical thing a shipper can do to prevent shattering.

(3) Padding the bulkhead was no solution for the problem of shattering.

(4) The greatest amount of shattering occurred in the top layer, next to the bulkhead and it became decreasingly less severe in lower layers and stacks away from the bulkhead.

(5) No attempt was made in these tests to compare varieties and maturities in respect to shattering. It is well known that over-mature fruit, weak fruit or that affected with decay or mold shatters easily and that varieties with weak pedicel attachment such as Thompson shatter more easily than Emperor, Ribier and Ohanez which have heavy pedicels.

Discussion of Tests

Shipments of August 31

The cars in this test were all loaded by the crosswise side-strip method. The slack amounted to as much as 3 inches in some cars before the load was squeezed (table 1). All slack was removed by the mechanical squeeze, in fact there was an apparent small compression and an inspection of the top of the loads showed them to be tight all the way back to the bulkhead. The train order of the test cars, type of draft gear, shipper and size of load are shown in table 2. The cars were consolidated at Fresno and set in the rear of the train in the order indicated (Fig. 1). They were evidently kept in this order for when they were floated over from Jersey City for unloading, 5 cars were in this order on the float. The routing was S.P., U.P., C.&N.W., I.H.B. and Erie, and all cars were shipped under standard refrigeration after precooling.

Impacts in transit

The longitudinal impacts (those greater than zone 2) experienced by these cars are shown in table 3. Instrument failure in MDT 9485 accounts for the lack of a record for this car. The impacts evidently occurred at certain places in transit, the heaviest ones being on September 5, 6, 7 and 10. The two most severe impacts were on September 6 and 10 at 4:30 P.M. and 3:30 P.M. respectively. One extended into zone 4 and the other into the upper half of zone 3. It is likely that these were the jolts that were responsible for breaking the brace in MDT 9471 and the shattering and wetness that developed. One car, MDT 9479, had practically no longitudinal impacts. This car had a spring cushion underframe and was located in the train between 2 cars similarly equipped. The car in which the brace was broken was equipped with rubber cushion draft gears and was next to a string of 3 cars with spring cushion underframes. The contention has been made that the lack of a conventional type of draft gear in the latter cars permits impacts to be passed through them to adjacent cars. This might be given as the reason for the brace failure in the car in question. Against this contention however, it is to be noted that all 3 cars with rubber cushion draft gears had heavy longitudinal shocks and that one of them, between 2 other cars with the same equipment, had the most severe shocks of all.

The cars with spring cushion underframes showed many more vertical impacts than those with rubber cushion gears (table 4). Most of them were small and of great frequency, and probably represent the vibration set up within the car. The heavy impacts of September 6 which failed to show on the record of longitudinal impacts of MDT 9479 (spring cushion underframe) were recorded as rather severe vertical impacts. Even higher ones were shown in the cars with rubber cushion draft gears. It is regrettable that instrument failure prevented a record being obtained for the one car with friction draft gears.

Inspection of loads

The inspection records of the commercial loads made by the Railroad Perishable Inspection Agency in New York are summarized in table 5. As was indicated earlier, MDT 9471 showed considerable shattering and wetness, especially in the top layer of the load near the bulkheads. The other six cars had less than 1 percent shattering and no wetness. The inspections of the 10 test lugs of fruit placed in the top layer of the bulkhead stacks are shown in table 6. Wetness was of no consequence except in the car with heavy shattering, MDT 9471. The shattering found in the test lugs of the other cars amounted to only about 2 percent of the fruit in the lug and was not considered serious. Evidently tight loads such as these were can withstand several heavy impacts without showing excessive shattering and wetness. There was some indication that the head end of the loads had more shattering than the rear end (9477, 9471, 9472 and 9485). In the single car where the opposite was true, the fruit was of high color and not comparable with that in the head end of the car.

Shipments of September 3

The cars in this test were loaded with vertical alignment strips (Hoak). They were all mechanically squeezed until no slack was left in the load, in fact compression was noted as in the first test (table 7). The train order of the test cars, type of draft gears, etc., are shown in table 8 and figure 1. All the cars moved under standard refrigeration service after precooling and they were routed the same as in the previous test.

Impacts in transit

Some very heavy longitudinal impacts were recorded (table 9). On September 8, MDT 9474 received an impact in zone 3 and on September 10 all cars experienced rough handling with MDT 9474 having an impact of zone 3.4 and MDT 9496, 5 impacts of about zone 3.3. The loads were tight enough and sufficiently well braced to withstand these shocks without breakage. The cars with spring cushion underframes had only 1 or 2 impacts in zone 2 or greater as compared with 7 and 8 in the cars with rubber cushion draft gears and 25 in the car with friction gears. There was no indication that MDT 9474 (rubber cushion draft gears) next to the cars with spring cushion underframes suffered therefrom for it had an impact record similar to the car with rubber cushion draft gears (MDT 9473) one car farther removed from the spring cushion underframe cars.

The record of vertical impacts (table 10) shows that the car with friction draft gears experienced most of them by far. Cars with spring cushion underframes and rubber cushion draft gears were about alike in respect to vertical impacts.

Inspection of loads

The loads showed no shifting or broken packages although some recooperage was necessary because of loose covers (table 11). Shattering and wetness was of no consequence in the commercial loads. An inspection of the 10 test lugs in each car (table 12) loaded in the most vulnerable position in respect to shattering, also showed only a small amount of wetness and shattering, ranging from 1 to 2.7 percent. The lugs in the head end of the cars had somewhat more shattering than those in the rear end and thus conformed, in this respect, with the observations made in the first test. The fact that in both tests the cars were at the rear of the train may have a bearing on the direction from which the impacts came, i.e. the slack in the train would be ahead of the test cars and also, it is most likely that the cars would be handled from the rear in switching, thus giving the head end the impacts of bumping into standing cars, etc.

The greatest amount of shattering in the test packages was in the fruit that had the weakest berry attachment, which measured 262 grams as compared with 340 grams for the other test lugs. In spite of the numerous impacts that MDT 9496 experienced, it showed a minimum amount of shattering. This is attributed to the fact that it was well squeezed and braced and loaded with fruit not too susceptible to shattering.

Shipments of October 13 and 14, 1948

Three loading methods were used in the 7 cars of Tokay grapes shipped from the Lodi district (table 13). All were mechanically squeezed but some of them had slack left in them. No attempt was made to keep the cars together in transit or to give them special handling. Excelsior pads of about 1/4 inch thickness were stapled to the bulkheads of some cars to see if they would minimize shattering and wetness by absorbing impacts.

Impacts in transit and condition on arrival

The car receiving the greatest number of longitudinal impacts of zone 2.1 or greater was PFE 7436. It had 30 of this magnitude, 6 of which were in zone 3 and 2 in zone 4 (table 14). The grapes in this car were loaded by the crosswise strip method and it was well squeezed, having only 1/4 inch of slack left (table 13). When the car arrived the load was intact but some lugs were 1 to 2 inches out of row alignment (table 14). There were no broken packages but 25 had to be recoopered because of loose covers. In the commercial load shattering was of no consequence, averaging 1 to 2 percent, and there was no wetness (table 16). Cars RD 7968 and RD 14674 were next in number of longitudinal impacts, having 14 and 13 respectively. One of them in the latter car was of zone 4.4 magnitude. Vertical impacts totaled 9 and 6 respectively in these cars (table 15). They were loaded alike by the 2 x 4 method, were squeezed but not center braced making a "through" load. They had 1-1/2 inches of slack left after squeezing. In some top layer lugs of RD 7968, 25 to 30 percent of the grapes were wet and many lugs had over 10 percent of the berries wet but shattering was not serious, amounting to only 1 to 2 percent (table 16). RD 14674 had 3 to 5 percent shattering in stacks next to the bunker, but less wetness, amounting to 4 to 15 percent. An inspection of test lugs loaded in the top layer of the bunker stacks showed considerable shattering in both cars (table 17). It amounted to 46 oz. per lug in RD 14674 (about 10 percent) and 25 oz. per lug in RD 7968. Wetness averaged 5 to 40 percent and 2 to 15 percent respectively in these cars. Probably the main factor contributing to shattering and wetness in these cars was the slack in the load. Padding the bulkheads of RD 7968 did not prevent shattering and wetness.

The wetness and shattering found in PFE 44009 and PFE 14465 cannot be evaluated since decay was present and it caused wetness and no doubt some shattering.

Two of the best records in respect to impacts in transit were obtained in PFE 75805 and RD 9282. They had only 6 each of zone 2.1 or greater. Only a few vertical impacts were recorded in these cars. The loads were not alike, for one was a crosswise strip load (PFE 75805) and the other was an Ellis 2 x 4 load, with center brace (RD 9282). Neither had any slack left after squeezing, in fact each showed 3/8" compression. They were the tightest loads in this series of tests. The loads in both cars were intact upon arrival but some lugs in PFE 75805 were 1-1/2 inches out of row alignment. In the commercial load of this car there was no wetness but an average of 1 to 2 percent shattering. In RD 9282 the commercial load was in similar condition, showing less than 1 to 3 percent shattering and 0 to 2 percent wetness. The test lugs in top layer bunker stacks averaged 15 oz. of shattered grapes in both cars (3.3 percent) with a trace to 3 percent wetness (table 17). There was no indication that padding the B end of RD 9282 did any good, in fact the test lugs next to the pads had more shattering than those in the unpadded end of the car.

Shipments of November 12 to 20, 1948

The final series of test cars for the season moved in November using Thompson Seedless grapes from storage (table 18). It was not always possible to get entire carloads of this variety and in some cases Emperors, Ohanez (Almeria) and Ribiers had to be used with test lugs of Thompson Seedless located in the top layer next to the bunkers. No attempt was made to obtain cars with different types of draft gears since the main comparison was to be between padded and unpadded bulkheads. However, 2 cars with spring cushion underframes were included since they were available.

Impacts in transit and condition on arrival

The car with the worst record in transit in respect to impacts was PFE 45800. It had 37 longitudinal impacts over zone 2.0, two of which were in zone 3.0 (table 19). This car had 6 vertical impacts of some magnitude (table 20). It was tightly loaded by the Hoak method and had no slack left in it after squeezing. When unloaded, shattering and wetness of the commercial load (Emperor and Almeria) amounted to less than 1 percent (table 21). Shattering in the test lugs of Thompsons loaded next to the bulkhead, top layer, averaged 2.7 percent and was no greater than in other cars with fewer impacts.

The best cars of all in respect to handling in transit were RD 36282 and RD 34310 (both with spring cushion underframes). They had no longitudinal impacts great enough to be tabulated (over 2.0) and they also had no vertical impacts of any consequence (tables 19 and 20). When unloaded in New York, the commercial loads showed less than 1 percent wet and shattered berries (table 21) and the test lugs of Thompsons showed no wetness but averaged 7 oz. and 6 oz. of shattered berries respectively (about 1.3 percent). This was a good record, but no better than RD 7600 which had 7 impacts in transit over zone 2.0 and one as great as zone 3.8. These three cars all were tight "gate" loads from the same shipper and were routed alike. The results with RD 7600 indicate that if the load is tight a considerable number of impacts can be suffered without damage to the grapes.

There were two cars in this series of tests in which shattering and wetness in the commercial load amounted to more than 1 to 2 percent and could be considered serious. These were PFE 50647 and RD 32142. The former car had bulkheads bowed outward and this left an inch or more slack in the center rows of the load. The car had only 2 longitudinal impacts in transit and no vertical ones of any consequence, yet the load showed some settling and slack in it upon arrival and some lugs had 25 percent of the berries wet (table 21). In the test lugs there was an average of 15 oz. of shattered berries (about 2.5 percent) and a trace to 5 percent wetness. It appears that slackness in the load due to faulty bulkheads was the main trouble.

RD 32142 had 10 lugs of Thompson Seedless in the commercial load that were set aside the morning following arrival because they had 10 to 20 percent of the berries wet and shattered, and about 6 percent of the berries were split or crushed. This fruit was generally dull and weak appearing. The inspection record does not show where these packages came from in the load. This car had 21 impacts in transit of zone 2.1 or greate hence some trouble might have been expected, except that the load was tight with 2-8/16 inch compression. Test packages loaded at a vulnerable position (top layer, bulkhead stack) showed only a small amount of shattering and wetness (table 22).

Value of pads on the bulkheads

These test cars in which one bulkhead was padded gave no indication that pads were of value in preventing shattering. In 5 of the 9 cars shattering was greater in the padded end than in the opposite end of the car. The reverse was true in the remaining 4 cars. Similar results were noted in the shipments of Tokay grapes. It is no doubt true that the two ends of the load experience different shocks in transit depending upon where the car is in the train, as mentioned earlier in the report, and this may be the reason for greater shattering in one end of the car than in the other, irrespective of pads. A pad thicker than the 1/4 inch pad used might give more protection but the results so far point to making the load as tight as possible rather than using cushioning material.

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Fresno, California
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Table 1. Grape load measurements in test cars shipped Aug. 31, 1948

Crosswise side strip

Car	Width Lug in. ave.	Width Strip in. ave.	No. Stacks	Length of load[1] Calculated	Length of load[1] Actual	Slack Inches	Amount squeezed Inches	Compressed Inches
1 - 9476	13-15/16	7/16	26	31' 14/16"	31' 3-8/16"	2-5/8	2-3/4	1/8
2 - 9479	14-9/16	7/16	25	31' 3"	31' 6"x	3	4	1
3 - 9477	13-15/16	7/16	25	29' 10-7/16	29' 11-3/4"	1-5/16	2-1/4	15/16
4 - 9471	13-15/16	7/16	25	29' 10-7/16	[2] - - -	[2] - -	- -	-
5 - 9470	14-1/16	7/16	25	30' 2-9/16"	30' 4-9/16x	2	4	2
6 - 9472	14-1/16	7/16	26	31' 4-2/16"	31' 6-6/16"	2-4/16	3	3/4
7 - 9485	13-15/16	7/16	25	29' 10-7/16"	30' 0-2/16"	1-11/16	2-4/16	9/16

[1] Does not include car strips on doorway stacks unless marked with X. Space between sides of lugs at doorway measured before and after squeezing and bracing and subtracted from inside length of car; in some instances, length of load from bulkhead to doorway measured.

[2] The measurements for the load were not taken before and after squeezing, hence the length of the brace plus the calculated length of the load was 5/16 inch less than the measured inside length of the car.

Table 2. Test cars shipped Aug. 31 in train order from Fresno, Calif. to Jersey City, N.J.

Car numbers in train order Caboose	Draft Gear	Shipper and shipping point	No. of lugs	Billing Wt. lbs.
1 - MDT 9476	Spring	M. Caratan, Quality	1,040	32,240
2 - MDT 9479	do.	P. J. Divizich, Ducor	1,000	31,000
3 - MDT 9477	do.	Di Giorgio Farms, Jovista	1,100	34,100
4 - MDT 9471	Rubber	do.	1,100	34,100
5 - MDT 9470	do.	Marko Zaninovich, Earlimart	1,000	31,000
6 - MDT 9472	do.	G. & M. Zaninovich, Trocha	1,040	32,240
7 - MDT 9485	Friction	DiGiorgio Farms, Jovista	1,100	34,100

Table 3. Longitudinal impacts recorded in
grape cars shipped Aug. 31, 1948.[1]

Number of impacts in zones indicated

Place	Date	Time	Spring cushion underframes 9476 (Inst.2477)	 9479 (Inst.310)	 9477 (Inst.314)	Rubber cushion draft gears 9471 (Inst.313)	 9470 (Inst.3209)	 9472 (Inst.312)
Delano,vic.	Aug.31	PM	1 - 3.5	0	0	0	0	0
	Sept.1	AM	0	0	0	0	0	0
Roseville		PM	0	0	0	0	0	0
	2	AM	0	0	0	0	0	0
Sparks		PM	0	0	0	0	0	0
Carlin	3	AM	0	0	0	0	0	0
		PM	0	0	0	0	0	0
Ogden	4	AM	0	0	0	0	0	0
		PM	0	0	0	0	0	0
Laramie	5	AM	0	0	0	1 - 2.3	0	0
		PM	0	0	0[2]	1 - 2.5	1 - 2.7	1 - 2.6
N. Platte	6	AM	0	0	-	0	0	0
Co. Bluffs		[3] PM	1 - 2.5 1 - 2.7	0	-	1 - 2.1 1 - 2.8 1 - 3.8	1 - 2.3 1 - 2.1 1 - 4.0 1 - 2.2	1 - 2.6 1 - 3.3 1 - 3.6
Clinton	7	AM	0	0	-	0	0	0
Chicago		PM	0	0[4]	-	1 - 2.1	1 - 2.3	1 - 2.1 1 - 2.3
	8	AM	0	0	-	0	0	0
		PM	0	0	-	0	0	0
	9	AM	0	0	-	0	1 - 2.4	0
		PM	0	0	-	0	0	0
	10	AM	0	0	-	0	0	0
		[5] PM	0	0	-	1 - 4.3[6]	1 - 4.8	1 - 3.8
	11	AM	0	0	-	0	0	0
		PM	0	0	-	0	1 - 2.1	0
	12	AM	0	0	-	0	0	0
New York, N.Y.		PM	0[7]	0	-	0	0[8]	0[9]
	Total		3	0	?	8	8	8

[1] No record for car with friction draft gears because of instrument failure.

[2] Clock stopped noon 9/5, tape perforated by stylus, record incomplete.

[3] Heavy impact experienced at 4:30 PM, Sept. 6, on cars head end of string.

[4] Clock stopped about 4:00 PM 9/7, vertical impacts recorded on 9/6 but no longitudinal ones then or rest of trip.

[5] Heavy impact experienced about 3:30 PM Sept. 10 on cars head end of train.

[6] Clock slow, 3 days and 14 hours late when instrument removed but OK up to Sept. 7, time of impacts from then on corrected to agree with accompanying cars.

[7] Time correct within 1/2 hr.

[8] Time correct within 1 hour.

[9] Clock stopped about noon Sept. 8, later impacts corrected for time.

Table 4. Vertical impacts recorded in grape cars shipped Aug. 31, 1948.

			Spring cushion underframes						Rubber cushion draft gears					
			MDT 9479			MDT 9477			MDT 9471			MDT 9472		
Place	Date	Time	.9-1.4 "G's"	1.5-3.0 "G's"	Over 3.0 "G's"	.9-1.4 "G's"	1.5-3.0 "G's"	Over 3.0 "G's"	.9-1.4 "G's"	1.5-3.0 "G's"	Over 3.0 "G's"	.91.4 "G's"	1.5-3.0 "G's"	Over 3.0 "G's"
Delano	Aug. 31	PM	0	0	0	0	3	1	0	2	0	1	2	0
Fresno,	Sept. 1	AM	40-50	0	0	42-45	3	0	0	0	0	0	0	0
Roseville		PM	55-70	0	0	75-80	9	0	0	0	0	1	0	0
	2	AM	13	0	0	9	1	0	0	0	0	1	0	0
Sparks		PM	20	0	0	50	9	0	1	0	0	0	0	0
Carlin	3	AM	50-70	0	0	120-135	19	0	0	0	0	0	0	0
		PM	70-90	0	0	70-80	9	0	0	0	0	0	0	0
Ogden	4	AM	27	0	0	65-70	7	0	1	0	0	0	0	0
		PM	60	0	0	80-100	16	0	0	0	0	2	0	0
Laramie	5	AM	18	0	0	40-45	3	0	2	0	0	0	0	0
		PM	15	0	0	clock stopped noon 9/5			1	0	0	0	0	1
N. Platte	6	AM	19	0	0	-	-	-	0	0	0	0	0	0
Co. Bluffs		PM	0	3	0	-	-	-	2	1	1	2	1	1
Clinton	7	AM	12	0	0	-	-	-	3	0	0	0	0	0
Chicago		PM	4	0	0	-	-	-	0	1	0	0	0	0
	8	AM	Clock stopped about 9 PM 9/7		-	-	-	-	Clock lost over 3 days' time from 9/7 to 9/12.			0	0	0
		PM	-	-	-	-	-	-	-	-	-	1	0	0
	9	AM	-	-	-	-	-	-	-	-	-	Clock stopped about noon 9/8.		
		PM	-	-	-	-	-	-	-	-	-			
	10	AM	-	-	-	-	-	-	-	-	-	-	-	-
		PM	-	-	-	-	-	-	0	0	1	-	-	-
	11	AM	-	-	-	-	-	-	-	-	-	-	-	-
		PM	-	-	-	-	-	-	-	-	-	-	-	-
	12	AM	-	-	-	-	-	-	-	-	-	-	-	-
New York, N.Y.		PM	-	-	-	-	-	-	-	-	-	-	-	-

Table 5. Conditions noted in cars shipped August 31, 1948 when inspected at destination.

(Commercial load inspection)

Car	MDT	Type	Condition of load	Recoopered Packages	Shattering and wetness
1 -	9476	Spring	Intact	0	Less than 1% shattered 1/ no wetness.
2 -	9479	do.	do.	7 (loose covers)	do.
3 -	9477	do.	do.	13 (loose side slats)	do.
4 -	9471	Rubber	Brace broken	12 (loose covers)	1 to 3% shattered, 5 to 15% wet, in some packages 2/
5 -	9470	do.	Intact	25 (cut side, sprung covers)	Less than 1% shattered, no wetness
6 -	9472	do.	do.	28 (sprung & broken covers)	do.
7 -	9485	Friction	do.	10 (loose covers)	do.

1/ Top layer and doorway inspection only, other cars all parts of load inspected.

2/ More detailed inspection notes on this car follows: 5 uprights of "A" gate of brace and 2 of "B" gate broken at center layer spreaders. Top 3 layers "B" end shifted 1/2 to 2-1/2 inches toward doorway, one lug end split. First 3 stacks each side of brace show less than 1% shatter and fruit was dry. Shattering of 1 to 3% found in balance of stacks "A" end, top layer (Thompsons and Khondahars) with wetness more severe nearing bunker, amounting 5 to 15% in stacks 2, 3 and 4; 3 to 10% in 5 and 6, less in 7 and 8. At "B" end, stacks, 2, 3 and 4 showed less than 1% shatter (Ribiers) and 3 to 5% wet. Stacks 4, 5 and 6, Muscats, less than 1% shattered but 5 to 10% wet. Balance of stacks Thompson seedless less than 1% shatter and dry. Wetness was principally in top layer and upper 1 to 3 inches of lug.

Table 6. Comparison of shattering and wetness of grapes in test lugs (5 each end), top layer next to bulkhead in cars shipped August 31, 1948.

		Shattered berries, average per lug		Percent of berries wet, average per lug	Original attachment-Grams
Car MDT		No.	Weight (oz.)	Pct.	
1 - 9476	Head end (B)	122	8	0	-
	Rear end (A)	122	8	0	-
	Average	122	8	0	275
2 - 9479	Head end (B)	45	5	0	295
	Rear end (A)	138	10	0	287 (yellow
	Average	92	7	0	-
3 - 9477	Head end (A)	103	11	0	-
	Rear end (B)	87	9	0	-
	Average	95	10	0-1	314
4 - 9471	Head end (A)	363	35	14-17	-
	Rear end (B)	221	24	6-8	-
	Average	292	29	10-12	314
5 - 9470	Head end (A)	115	10	0-1	-
	Rear end (B)	123	11	0-1	-
	Average	119	10	0-1	262
6 - 9472	Head end (A)	139	11	1-2	-
	Rear end (B)	81	7	0	-
	Average	110	9	0-2	286
7 - 9485	Head end (A)	127	13	0-1	-
	Rear end (B)	94	9	trace	-
	Average	110	11	0-1	314

Table 7. Grape load measurements in test cars shipped September 3, 1948.

Crosswise side strip loads

Car	Width of lug Inches	Average width of strips Inches	No. of stacks	Length of load Theoretical	Length of load Actual	Slack Inches	Amount squeezed Inches	Compressed Inches
- MDT								
8 - 9473	13-15/16	5/16	25	29' 7-10/16"	29' 10-15/16"	3-5/16	4	11/16
9 - 9474	14	11/32	26	31' 4/16"	31' 4"	3-12/16	4-1/2	12/16
10 - 9475	14-1/16	11/32	25	29' 11-9/16"	30' 1/2"	11/16	3-5/8	2-15/16
11 - 9478	14	10.6/32	25	29' 9-10/16"	30' 2/16"	2-8/16	4	1-8/16
12 - 9496	14	10.6/32	25	29' 9-10/16"	29' 11-8/16"	2-2/16	4-3/8	2-4/16

Table 8. Test cars shipped Sept. 3 in train order from Fresno, Calif. to Jersey City, N. J.

Car numbers in train order	Draft gear	Shipper and shipping point	No. of lugs	Billing Wt. lbs.
Caboose				
8-MDT 9473	Rubber	DiGiorgio Farms, Jovista	1,100	34,100
9-MDT 9474	do.	M. Caratan, Quality	1,040	32,240
10-MDT 9475	Spring	Marko Zaninovich, Earlimart	1,000	31,000
11-MDT 9478	do.	DiGiorgio Farms, Jovista	1,100	34,100
12-MDT 9496	Friction	do. do.	1,100	34,100

Table 9. Longitudinal impacts recorded in cars shipped September 3, 1948.

Number of impacts in zones indicated

			Rubber cushion gears		Spring cushion underframe		Friction gears
Place	Date	Time	9473 Inst. 311	9474 Inst. 1049	9475 Inst. 309	9478 Inst. 306	9496 Inst. 307
Delano,vic.	Sept.3 -	PM	0	0	0	0	1 - 2.2
	4 -	AM	0	0	0	0	0
Roseville		PM	0	0	0	0	1 - 2.7 3 - 2.2
	5 -	AM	1 - 2.3	0	0	0	0
Sparks		PM	0	0	0	0	1 - 2.1
Carlin	6 -	AM	0	0	0	0	
Ogden		PM	0	1 - 2.2	0	0	0 2 - 2.1
	7 -	AM	0	0	0	0	2 - 2.1
Laramie		PM	0	0	0	0	0
N. Platte	8 -	AM	1 - 2.3 1 - 2.4	1 - 3.1	0	0	0
		PM	0	1 - 2.2	0	0	1 - 2.7
	9 -	AM	0	0	0	0	0
		PM	0	0	0	0	1 - 2.1
Chicago	10 -	AM	1 - 2.2 1 - 2.6	1 - 2.3 1 - 3.4	1 - 2.2	1 - 2.3	5 - 3.3
		PM	2 - 2.7	1 - 2.8	0	0	2 - 2.1 4 - 2.2
	11 -	AM	0	0	0	0	1 - 2.2
		PM	0	0	0	0	0
	12 -	AM	0	0	0	0	0
		PM	1 - 3.3	1 - 2.6	1 - 2.3	0	1 - 2.3
New York	13 -	AM	0	0	0	0	0
Unloaded		PM	0	0[1]	0	0	0
Total			8	7	2	1	25

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[1] Correct within 1/2 hour, other records corrected by this one, for clocks had run down or stopped about 2 days prior to arrival.

Table 10. Vertical impacts recorded in cars shipped September 3, 1948.

			Rubber cushion gears			Spring cushion underframe						Friction gears		
			MDT 9473			MDT 9475			MDT 9478			MDT 9496		
Place	Date	Time	.9-1.4	1.5-3.0	Over 3.0	.9-1.4	1.5-3.0	Over 3.0	.9-1.4	1.5-3.0	Over 3.0	.9-1.4	1.5-3.0	Over 3.0
Delano	Sept. 3	PM	1	1	0	3	2	0	3	0	1	5	2	0
	4	AM	0	0	0	0	0	0	0	0	0	26	0	0
Roseville		PM	0	0	0	0	0	0	0	0	0	44	0	0
	5	AM	0	0	0	0	0	0	0	0	0	6	0	0
Sparks		PM	0	0	0	2	0	0	0	0	0	42	3	0
Carlin	6	AM	0	0	0	0	0	0	0	0	0	125-175	4	0
Ogden		PM	0	0	0	0	0	0	0	0	0	95-110	2	1
	7	AM	1	0	0	0	0	0	0	0	0	95-110	3	0
Laramie		PM	0	0	0	0	0	0	0	0	0	55-65	2	0
N. Platte	8	AM	1	0	0	0	0	0	0	0	0	65-75	4	0
		PM	0	1	0	0	0	0	0	0	0	20-35	0	1
	9	AM	0	0	0	0	0	0	0	0	0	30-80	0	0
		PM	2	0	0	0	0	0	0	0	0	100	3	0
Chicago	10	AM	0	1	0	0	0	0	1	0	0	60	2	1
		PM	0	3	0	0	0	0	-	-	-	67	8	1
	11	AM	0	0	0	0	0	0	-	-	-	65	0	0
		PM	-	-	-	-	-	-	-	-	-	-	-	-
	12	AM	-	-	-	-	-	-	-	-	-	-	-	-
		PM	-	-	-	-	-	-	-	-	-	-	-	-

Table 11. Conditions noted in cars shipped September 3, 1948 when inspected at destination.
(Commercial load inspection)

Car	MDT	Type	Condition of load	Packages to be recoopered	Shattering and wetness
8 -	9473	Rubber	Intact	0	Less than 1% to 1% shattered; no wetness.
9 -	9474	do.	do.	8 (loose covers)	do.
10 -	9475	Spring	do.	5 (loose and split covers)	Less than 1% shattered; no wetness.
11 -	9478	do.	do.	5 (do.)	Less than 1% to 1% Thompsons shattered, 2 to 3% Khandahars.
12 -	9496	Friction	do.	0	Less than 1% to 1% shattered, no wetness.[1/]

[1/] Top layer lugs (Thompson Seedless) stacks 2 to 4, show 1 to 5 shattered wet, brownish berries on top of packs. Top layer, stack 1 consisted of test lugs, inspection shown in table 12.

Table 12. Comparison of shattering and wetness of grapes in test lugs (5 each end) loaded in top layer next to bulkhead in cars shipped September 3, 1948.

Car MDT		Shattered berries average per lug No.	Shattered berries average per lug Weight (oz.)	Percent of berries wet average per lug Pct.	Original attachment Grams
8 - 9473	Head end (A)	92	9	Less than 1%	-
	Rear end (B)	83	7	0 to trace	-
	Average	88	8	0 to less than 1%	344
9 - 9474	Head end (A)	92	8	0	-
	Rear end (B)	80	7	0 to trace	-
	Average	86	7.5	0 to trace	340
10 - 9475	Head end (A)	182	14	0 to 5%	-
	Rear end (B)	148	11	0 to 2%	-
	Average	165	12.5	0 to 5%	262
11 - 9478	Head end (A)	133	13	0 to 1%	-
	Rear end (B)	86	9	0	-
	Average	110	11	0 to 1%	344
12 - 9496	Head end (B)	78	10	0 to trace	-
	Rear end (A)	63	6	0	-
	Average	71	8	0 to trace	344

Table 13. Test cars of Tokay grapes shipped from the Lodi, Calif. district Oct. 13 and 14, 1948.

Car	Loading method	Number of lugs	Slack left after squeeze Inches	Bulkheads padded	Shipper	Routing
13- RD 14674 [1]	Ellis 2 x 4, crosswise thru 5 wide, 8 high, 28 stacks	1120	1-1/2	No	Dougherty Fruit Growers	Santa Fe, Erie
14-PFE 7436[2] [3]	Crosswise strip, 5 wide, 8 and 9 high, 26 stacks	1105	1/4	No	Vito Fruit Growers	do.
15-PFE 75805	do.	1105	None, 3/8" compression	Yes	do.	S.P.,U.P., C&N.W.,Erie
16- RD 9282[2]	Ellis 2 x 4, crosswise, braced 5 wide, 8 and 9 high, 26 stacks	1105	do.	Yes, B end	Eastside Fruit Growers	Santa Fe, Erie
17- RD 7968	Ellis 2 x 4 thru, crosswise 5 wide, 8 high, 28 stacks	1120	1-1/2	Yes	Dougherty Fruit Growers	do.
18-PFE 44009	Crosswise gate load, 5 wide, 8 and 9 high, 26 stacks	1105	1-13/16	No	California Fruit Exchange	Santa Fe, Penn.,L.I.RR.
19-PFE 14465	do.	1105	5/16	Yes	do.	do.

[1] Grapes in this car were picked before the rain of October 11, and were held in storage until shipped.

[2] A-3 ride control springs in these cars.

[3] The test lugs and most of the grapes in the car were picked before the rain and the car was finished with fruit picked after the rain.

Table 14. Longitudinal impacts recorded in cars shipped October 14 and 15, 1948 [1]

Date	Time	Number of impacts in zones indicated						
		RD 14674 (Inst. 313)	PFE [2] 7436 (Inst.3209)	PFE 75805 (Inst.309)	RD [2] 9282 (Inst.312)	RD 7968 (Inst.314)	PFE 44009 (Inst.307)	PFE 14465 (Inst.311)
Oct. 13	AM	-	-	-	-	-	-	-
	PM	1 - 2.1	0	-	-	-	-	-
14	AM	1 - 2.4	0	0	0	0	-	-
	PM	1 - 2.2	1 - 2.2 1 - 2.5	0	0	0	0	0
15	AM	0	3 - 2.8 1 - 2.6 3 - 2.2	0	0	0	0	1 - 2.1
	PM	0	1 - 2.5 2 - 2.1	0	0	0	0	0
16	AM	0	4-2.5 3-3.1 2-2.8 1-3.5 1-2.3 4-2.1	0	0	0	0	0
	PM	0	1-4.2 1-2.5 1-3.2 1-2.2	0	0	0	0	0
17	AM	0	0	0	0	1 - 2.1	0	0
	PM	1 - 2.2	0	0	0	1 - 3.1	0	0
18	AM	0	0	1 - 2.1	0	2 - 2.1	1 - 2.1	0
	PM	0	1 - 2.8 1 - 3.4	0	0	1 - 2.1	0	0
19	AM	2 - 2.8 1 - 3.2 1 - 4.4 1 - 2.1	1 - 2.1	0	0	1 - 2.1	2 - 2.1	0
	PM	1 - 2.5	1 - 2.5 1 - 2.1 1 - 4.6	1 - 2.3	0	1 - 2.1 1 - 2.4	1 - 2.5	1 - 2.7
20	AM	Clock stopped	1 - 2.2	0	0	0	0	0
	PM		0	0	0	0	0	0
21	AM		0	1 - 2.2 1 - 2.1	2 - 2.1	1 - 2.2	1 - 2.3 1 - 2.5	0
	PM		0	Clock stopped	1 - 2.3	1 - 2.3 2 - 2.2 1 - 2.6 1 - 2.5	1 - 2.4	0
22	AM		0	Impacts during this period 1 - 2.1 1 - 2.2 also others not readable	1 - 2.8 1 - 3.3 1 - 2.1	Clock stopped	3 - 2.1 1 - 2.2 1 - 2.7	1 - 3.5 1 - 2.8
	PM	Impacts during this period 1 - 3.2 1 - 2.7 1 - 2.4	1 - 2.1		Clock stopped		Clock stopped	Clock stopped
23	AM		0		No severe impacts	No severe impacts	No severe impacts	No severe impacts
	PM		0					
24	AM		0					
	PM	Arrived 8PM	Arrived 7:50 PM	Arrived 7:45 PM		Arrived 8:30 PM		
25	AM							
	PM				Arrived 7:55 PM		Arrived 5PM 10/27	Arrived 5:10PM 10/27
Total		13	39	6	6	14	12	4

[1] All cars with friction draft gears as far as could be determined.

[2] A-3 ride control trucks on these cars.

Table 15. Vertical impacts recorded in grape cars shipped Oct. 14 and 15, 1948.

		RD 14674			PFE 75805			RD 9283			RD 7968			PFE 44009		
Date	Time	.9-1.4	1.5-3.0	Over 3.0	.9-1.4	1.5-3.0	Over 3.0	.9-1.4	1.5-3.0	Over 3.0	.9-1.4	1.5-3.0	Over 3.0	.9-1.4	1.5-3.0	Over 3.0
Oct. 13	AM	1	0	1	-	-	-	-	-	-	1	1	0	-	-	-
	PM	0	0	0	0	0	0	-	-	-	0	0	0	-	-	-
14	AM	0	0	0	0	0	0	-	-	-	0	0	0	-	-	-
	PM	0	0	0	0	0	0	2	1	0	0	0	0	1	0	1
15	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0
18	AM	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0
20	AM	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
	PM	Clock stopped			0	0	0	0	0	0	0	0	0	1	0	0
21	AM				0	1	0	0	0	0	0	0	0	0	0	0
	PM				Clock stopped			0	0	0	0	0	0	0	0	0
22	AM	2 vertical impacts						0	1	1	Clock stopped			1	0	0
	PM	of 2.4 G. in this period			2 vertical impacts in this period			Clock stopped						Clock stopped		
23	AM				1.2 G. and 1.9 G.						No severe impacts					
	PM							No severe impacts								
24	AM															
	PM	Arrived 8:00 PM			Arrived 7:45 PM						Arrived 8:30 PM			No severe impacts		
25	AM	-	-	-	-	-	-	-		-						
	PM	-	-	-	-	-	-	Arrived 7:55 PM						Arrived 5 PM 10/27		

Table 16. Conditions noted in cars shipped October 14 and 15 when inspected at destination. (Commercial load inspection)

Car	Condition of load	Packages to be recoopered	Shattering and wetness
13 - RD 14674	Intact, some "V" spacers separated.	41 (loose and cut sides, covers)	Stacks 1 & 2[1], 3 to 5% shattered, 4 to 15% wet.
14 - PFE 7436	Intact, some lugs 1 to 2" out of row alignment	25 (loose covers)	Occasional lug 5% shatter, average 1 to 2%, no wetness.
15 - PFE 75805	Intact, some lugs up to 1-1/2" out of alignment	10 (loose covers, broken slats)	do.
16 - RD 9282	Intact	14	Less than 1 to 3% shattered berries, 0 to 2% wetness, few 3 to 5% top layer.
17 - RD 7968	Intact, some "V" spacers out of place, lugs out of alignment.	0	1 to 2% shattered, wetness as much as 25 to 50%[2].
18 - PFE 44009	Intact	-	Average 1% shattered
19 - PFE 14465	do.	-	Average 2% shattered

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[1] Detailed inspection showed about 1% wet and shattered berries in all stacks except 1 and 2. In stack 2, 3 to 4% shattered and wet; stack 1, 5% shattered, 15% wet in top layers only. Lower layers these stacks only 1% wet and shattered.

[2] Wetness by stack and layer -

	A end Top layer	B end Top layer	Next top
Stack 2 -	10 - 15%	25 - 50%	5 - 10%
Stack 3 -	5%	10 - 50%	1 - 2%
Stack 4 -	0 - 2%	5 - 8%	0
4th to doorway	-	5 - 8%	0

Table 17. Comparison of shattering and wetness of grapes (Tokay) in test lugs (5 each end) loaded in the top layer next to bulkhead in cars shipped October 14 and 15, 1948.

		Shattered berries Average in lug		Percent of berries wet Average per lug
Car		Number	Weight (oz.)	
13 - RD 14674	A-end	305	56	5 - 40
(No pads)	B-end	228	36	20 - 35
	Average	267	46	5 - 40
14 - PFE 7436	A-end	56	9	0 to trace
(No pads)	B-end	83	16	0 to 2
	Average	69	12	0 to 2
15 - PFE 75805	A-end	58	11	Trace to 1
(Pads)	B-end	118	20	Trace to 3
	Average	88	15	Trace to 3
16 - RD 9282	A-end	67	12	do.
(Pads B	B-end	105	19	do.
end only)	Average	87	15	do.
17 - RD 7968	A-end	91	16	2 to 10
(Pads)	B-end	240	35	3 to 15
	Average	166	25	2 to 15
18 - PFE 44009	A-end	391	63	50 to 100 (5 to 10% decay)
(No pads)	B-end	109	18	10 to 30 (0 to 3% decay)
	Average	250	41	10 to 100
19 - PFE 14465	A-end	123	19	2 to 10 (3 to 10% decay)
(Pads)	B-end	213	35	5 to 60 (1 to 10% decay)
	Average	168	27	2 to 60

Table 18. Test cars shipped November 12 to 20, 1948.

Car [1]	Date shipped	Loading method	Number of lugs	Slack after squeeze Inches	Pads	Shipper	Routing
20 PFE 45800	Nov. 12	Hoak	1125	5/32 compression	B end	Marko Zaninovich, Earlimart	S.P., U.P., C&N.W., Erie
21 PFE 45256	do.	Side strip	1040	15/16 compression	A end	M. Caratan, Quality	S.P., U.P., C&N.W.
22 RD 15171	Nov. 13	do.	1125	1/2 compression	B end	Divizich, Ducor	Santa Fe, TPW, NKP, Erie
23 PFE 50647	do.	Hoak	1125	3/32 slack [2]	A end	Marko Zaninovich, Earlimart	S.P., U.P., C&N.W., Erie
24 ART 28009	Nov. 15	Side strip	1040	1-6/16 compression	A end	M. Caratan, Quality	Santa Fe, TPW, NYC, St.L, Erie
25 REX 1578	Nov. 16	do.	1120	1-5/16 slack	A end	do.	S.P. test
26 RD 32142	Nov. 15	Gate	1100	2-8/16 compression	B end	Bonn Packing Co., Orange Cove	Santa Fe., Erie
27 RD 36282	Nov. 18	do.	1100	6/16 slack	B end	do.	do.
28 RD 34310	Nov. 19	do.	1100	6/16 compression	A end	do.	do.
29 RD 7600	Nov. 20	do.	1100	3/16 slack	A end	do.	do.

[1] All cars with friction draft gears as far as could be determined, except REX 1578 (unknown) and RD 36282 and RD 34310 which had spring cushion underframes.

[2] Bulkheads bowed outward, may be 1 inch slack in center rows of load.

Table 19. Longitudinal impacts recorded in cars shipped November 12 to 20, 1948 1/

Number of impacts in zones indicated

Day	Time	Nov. 12 PFE 45800 Inst.316	PFE 45256 Inst.314	Nov. 13 PFE 50647 Inst.310	Nov. 15 ART 28009 Inst.312	RD 32142 K3209	Nov. 16 REX 1578 Inst.309	Nov. 18 RD 36282 Inst.307	Nov. 19 RD 34310 Inst.311	Nov. 20 RD 7600 Inst.313
Load-ing	AM	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0
1st	AM	2 - 2.1 1 - 2.6	0	0	0	2-2.1 1-2.4	0	0	0	1 - 2.1 1 - 2.7
	PM	0	0	0	0	2-2.2 1-2.4	0	0	0	0
2nd	AM	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0
3rd	AM	0	0	0	1 - 2.1	0	0	0	0	0
	PM	1 - 2.5 1 - 2.1	1 - 2.1	0	0	0	0	0	0	0
4th	AM	3 - 2.1	0	0	0	0	0	0	0	0
	PM	4 - 2.2 2 - 2.1	0	0	0	0	0	0	0	0
5th	AM	2 - 2.5 1 - 2.9	3 - 2.5	0	0	1-2.3	0	0	0	0
	PM	0	1 - 2.5 2 - 2.1	1 - 2.2	1 - 2.2	0	0	0	0	0
6th	AM	2 - 2.7 1 - 2.1	2 - 2.1 2 - 2.2	0	1 - 2.4 1 - 2.3	0	1 - 3.3 arrived	0	0	1 - 2.2 1 - 2.5
	PM	0	0	0	1 - 2.7 1 - 2.4	1-2.7 1-2.2 1-2.4	3:30 AM 11/22 Express car.	Clock stopped	0	Clock stopped
7th	AM	1 - 2.1 1 - 2.3 1 - 2.7	1 - 2.1 Arrived Chicago	0	Clock stopped	1-3.2 2-2.1 1-2.4			Clock stopped	
	PM	2 - 3.0 1 - 2.5 7 - 2.2	7:30 AM 11/19	Clock stopped		1-2.6 1-2.3				1 - 3.4 1 - 3.8 1 - 2.1
8th	AM	3 - 2.2			1 - 3.3	0		No Impacts		During this
	PM	Clock stopped			1 - 3.1 2 - 2.5	0		exceeding zone 1	No Impacts	period
9th	AM			1 - 2.7	1 - 2.3	1-2.1			exceeding zone 1	
	PM	1 - 2.5		during this period	during this period	1-2.3 1-2.1 1-2.2				Arrived 8:55PM 11/29
10th	AM	Arrived 1:00 AM			Arrived	0		Arrived	Arrived 12:50 AM	
	PM	11/22			11/25	1-2.2 Arrived 8:45PM		8:45PM 11/28	11/29	
11th	AM			Arrived		11/25				
	PM		(Chicago)	2:05 PM 11/24			Express car			
Total		37	12	2	11	21	1	0	0	7

1/ All cars with friction draft gears except REX 1578 (unknown) and RD 36282 and RD 34310 which had spring cushion underframes.

Table 20. Vertical impacts recorded in cars shipped November 12 to 20, 1948.

		PFE 45800			PFE 45256			PFE 50647			ART 28009			REX 1578			RD 36282			RD 34310			RD 7600		
Day	Time	.9 1.4	1.5 3.0	Over 3.0	.9 1.4	1.5 3.0	Over 3.0	.9 1.4	1.5 3.0	Over 3.0	.9 1.4	1.5 3.0	Over 3.0	.9 1.4	1.5 3.0	Over 3.0	.9 1.4	1.5 3.0	Over 3.0	.9 1.4	1.5 3.0	Over 3.0	.9 1.4	1.5 3.0	Over 3.0
Load-ing	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1st	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
	PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2nd	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3rd	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4th	AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5th	AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PM	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6th	AM	0	0	0	1	1	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0
	PM	0	0	0	0	0	0	0	0	0	0	0	0	arrived 3:30 AM 11/22			Clock stopped			0	C	0	Clock stopped		
7th	AM	2	2	0	1	1	0	0	0	0	Clock stopped						00	0	0	0	0	0			
		0	0	0	Arrived Chicago 7:30AM 11/19			Clock stopped			0	0	0				0	0	0	Clock stopped			1	1	8
8th	AM	0	0	0				0	0	0	0	0	0				0	0	0	0	0	0			
	PM	0	0	0				0	0	0	0	0	0				0	0	0	0	0	0			
9th	AM	Clock stopped						0	0	0	0	0	0				0	0	0	0	0	0			
	PM	0						0	0	0	0	0	0				0	0	0	0	0	0			
10th	AM	Arrived 1 AM 11/22						0	0	0	Arrived 11/25						0	0	0	Arrived 12:50AM 11/29					
	PM							0	0	0							Arrived 8:45PM 11/18						Arrived 8:50 PM 11/29		
11th	AM.							0	0	0															
	PM							Arrived 2:05PM 11/24																	

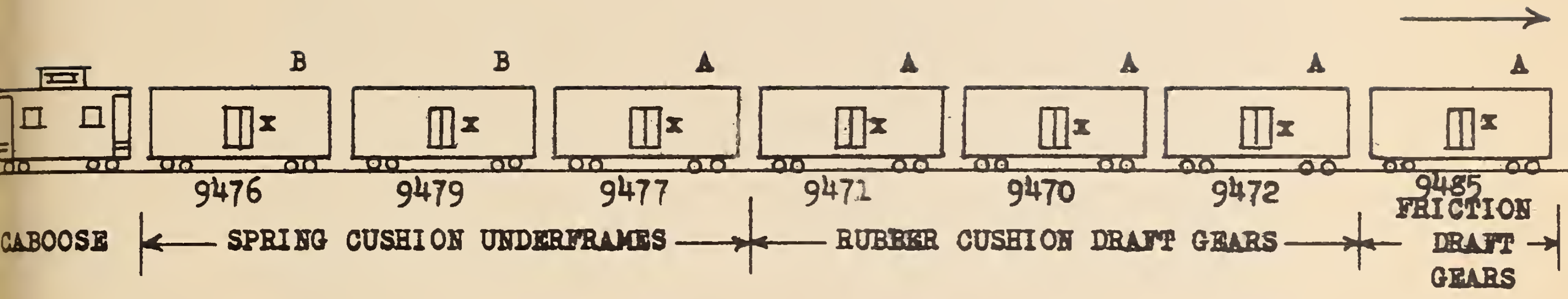
Table 21. Conditions noted in cars shipped November 15 to 20 when inspected at destination. (Commercial load Inspection)

Car	Condition of load	Packages to be recoopered	Shattering and wetness
20 - PFE 45800	Intact	9 (loose split covers)	Emperors, Almerias; less than 1% shattered; wetness
21 - PFE 45256	-	-	- - -
22 - RD 15171	Intact, few lugs out of crosswise alignment	16 (loose covers, sides)	Ribiers, Ohanez; less than 1% shattered; wetness
23 - PFE 50647	Intact, some settling and slack in load 1/	20 (cracked, split covers)	Emperors, Ohanez; less than 1% shattered; 1-25% wet.
24 - ART 28009	Intact, some lugs out of row alignment	5 (loose covers)	Thompsons; 1-2% shattered less than 1% wet: Emperors and Ohanez; less than 1% shattered; no wetness.
25 - REX 1578	Intact	7 (loose covers)	Ohanez, Emperor, Ribier; less than 1/2% shattered, 1% wet: Thompson 1-2% shattered; less than 1% wet.
26 - RD 32142	Intact	0	10 lugs Thompson show 10-20% wet shattered.
27 - RD 36282	Intact	7 (loose covers)	Less than 1% wet, shattered berries (Thompson)
28 - RD 34310	Intact	2 (loose covers)	Less than 1% wet, shattered (Thompson)
29 - RD 7600	Intact	4 (loose covers)	Less than 1 to 1% wet, shattered berries.

1/ Stacks next to bunkers settled 1/2 to 1 inch B end of car, 1 to 3 inches A end, center row 2nd stack A end settled 1-2 inches below normal load level. Space of 1/2 inch between bulkhead B end and 1st stack.

Table 22. Comparison of shattering and wetness of grapes in test lugs (5 each end) loaded in top layer next to bulkheads in cars shipped November 15 to 20, 1948.

Car		Shattered berries Average per lug Number	 Weight (oz.)	Percent of berries wet Average per lug Pct.	Decay
20-PFE 45800	A-end	236	19	1 to 6	1 - 7
	B-end (pads)	164	12	Trace - 5	Trace to 5
	Average	200	16	Trace to 6	Trace to 7
21-PFE 45256	A-end (pads)	-	15	None	0
(Chicago)	B-end	-	11	do.	0
	Average	-	13	do.	0
22-RD 15171	A-end	144	10	1 - 5	0
	B-end (pads)	183	12	5 - 40	0
	Average	163	11	1 - 40	0
23-PFE 50647	A-end (pads)	183	13	2 - 5	Trace - 1
	B-end	197	18	Trace - 5	0 - Trace
	Average	180	15	Trace - 5	0 - Trace
24-ART 28009	A-end (pads)	197	19	Trace - 5	0
	B-end	166	14	Trace	0
	Average	182	16	Trace - 5	0
25-REX 1578	A-end (pads)	228	18	0	0
	B-end	199	16	0	0
	Average	214	17	0	0
26-RD-32142	A-end	124	10	Trace - 4	[illegible] - Trace
	B-end (pads)	114	7	1 - 5	0
	Average	119	9	Trace - 5	0 - Trace
27-RD 36282	A-end	98	10	0	0
	B-end (pads)	52	5	0	0
	Average	75	7	0	0
28-RD 34310	A-end (pads)	88	7	0	0
	B-end	65	5	0	0
	Average	76	6	0	0
29-RD 7600	A-end (pads)	111	8	Trace	0
	B-end	81	6	Trace	0
	Average	96	7	Trace	0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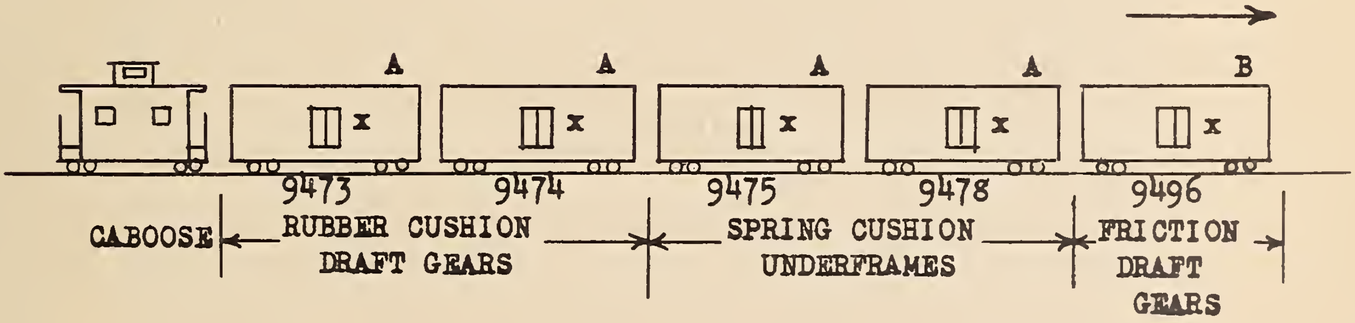
CABOOSE
SPRING CUSHION UNDERFRAMES
RUBBER CUSHION DRAFT GEARS
FRICTION DRAFT GEARS

AUGUST 31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9475
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CABOOSE
RUBBER CUSHION DRAFT GEARS
SPRING CUSHION UNDERFRAMES
FRICTION DRAFT GEARS

SEPTEMBER 3

x = Impact Recorders

Figure 1. Diagram of test cars shipped August 31 and September 3.

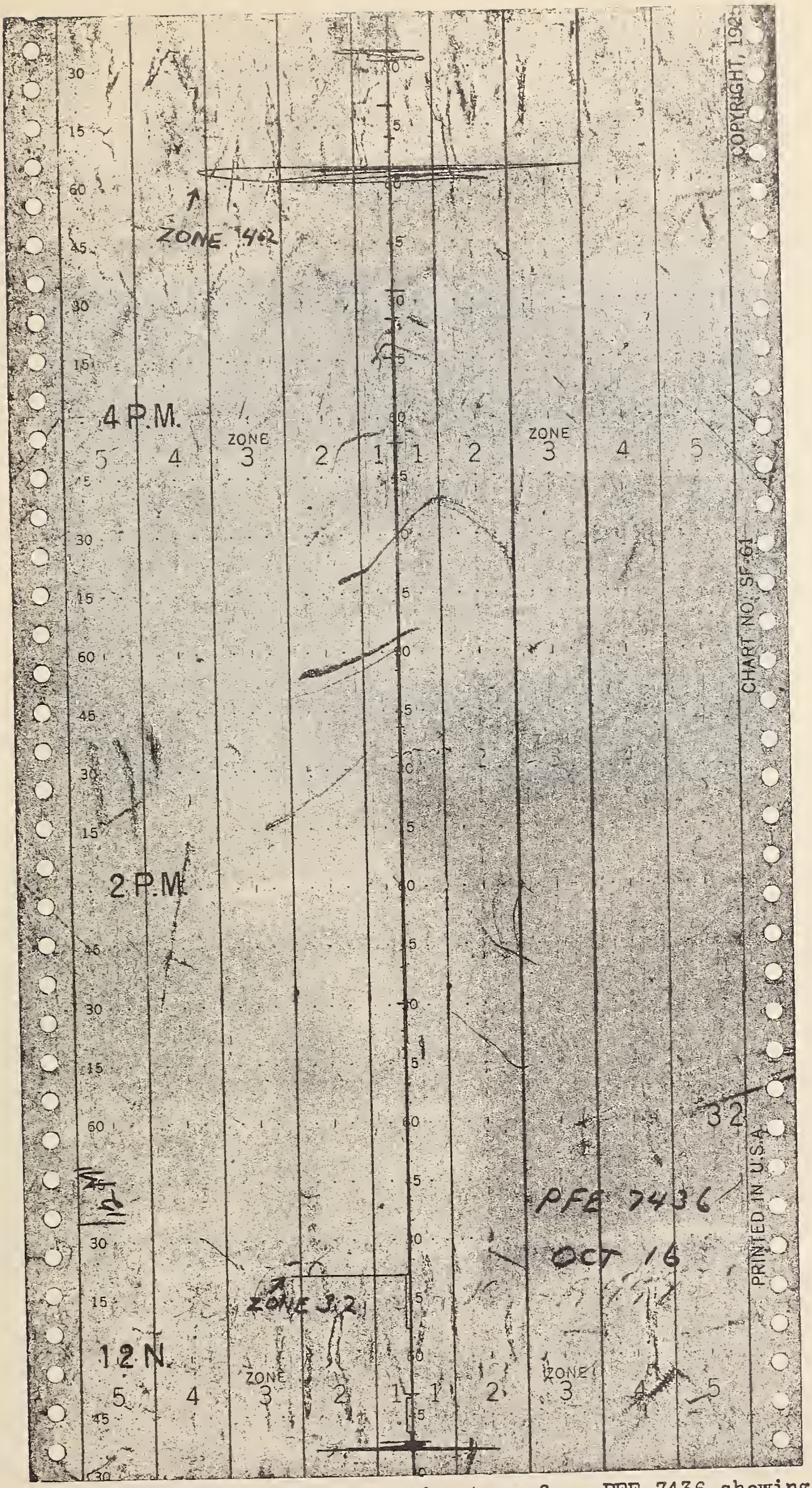

Figure 2. Portion of impact recorder tape from PFE 7436 showing several large impacts experienced in transit on October 16.

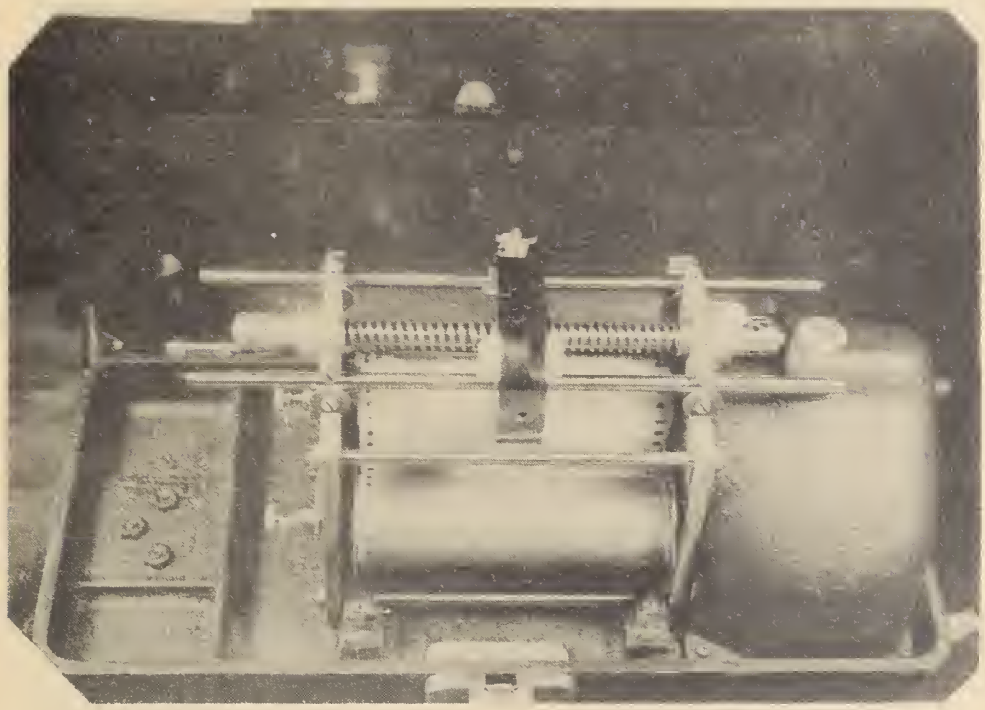

Figure 3. Impact recorder used to measure longitudinal impacts in transit.